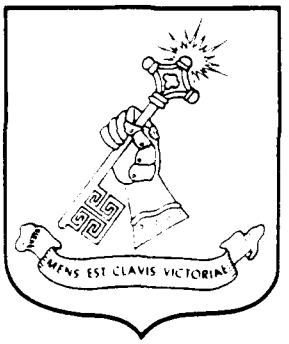
Operational Synchronization: A Revised Doctrinal Perspective

A Monograph
by

Major Timothy D. Lynch
Infantry



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The paper examines the concept of operational synchronization to determine how the concept should be portrayed in the upcoming revision of FM 100-5, Operations. This study first examines implications of theory of the operational art on the concept of synchronization. Next, the paper examines the historical development and current doctrinal procedures as outlined in FM 100-5. The current version of operational synchronization is then analyzed using six criteria: time-medium-force windows of effects, operational objectives, sequencing, flexibility, economy of force, and future-orientation.

The results of this doctrinal examination are used to suggest some refinements to the concept of operational synchronization and demonstrate them using a synchronization planning methodology. The author concludes with some implications for the development of the concept of operational synchronization in the upcoming revision of FM 100-5. (See reverse)

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The paper also contains some other conclusions and implications. Key JCS manuals do not address the synchronization concept. Also, the development of synchronization as an Army doctrinal concept parallels the development of the operational art. The author also suggests that a campaign planning process can be built around planning for and synchronizing first effects, then actions. Joint doctrine writers and other services should consider incorporating this concept into their doctrine. Also, the TRADOC Operational Operating Systems may be useful tools for the operational artist.

Finally, more study remains to be done in this area. Some topics that need to be considered are measurement of effects, delineation of medium boundries, existence of a vertical hierarchy of doctrine in the DoD, and linkages of FM 100-5 to JCS doctrine and other Army doctrine.

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OK, kids, the computer's all yours.

ABSTRACT

OPERATIONAL SYNCHRONIZATION: A REVISED DOCTRINAL PROSPECTIVE, by MAJ Timothy D. Lynch, USA, 50 pages.

The paper examines the concept of operational synchronization to determine how the concept should be portrayed in the upcoming revision of FM 100-5, Operations. This study first examines implications of theory of the operational art on the concept of synchronization. Next, the paper examines the historical development and current doctrinal procedures as outlined in FM 100-5. The current version of operational synchronization is then analyzed using six criteria: time-medium-force windows of effects, operational objectives, sequencing, flexibility, economy of force, and future-orientation.

The results of this doctrinal examination are used to suggest some refinements to the concept of operational synchronization and demonstrate them using a synchronization planning methodology. The author concludes with some implications for the development of the concept of operational synchronization in the upcoming revision of FM 100-5.

Several conclusions are drawn from this research. First, synchronization of effects and actions appears to be the "heart" of AirLand Battle doctrine and operational art.

Next, the current concept is most useful at the tactical level in the JCS-defined operational state of war. Even so, this concept is a good starting point for an umbrella concept that applies to the operational artist. A more holistic view of actions and effects needs to be built into the present concept. The author suggests the concept of time-medium-force windows better portrays effects at the operational level. These windows of effects can even be used in synchronizing effects at the tactical level. The revised concept also needs to incorporate space, EW, and psyops mediums. It also needs to address the impact of civilian agencies in the operational artist's area of operations.

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Introduction

(1) What military CONDITIONS must be produced in the theater of war or operations to achieve the strategic goal?
(2) What SEQUENCE of actions is most likely to produce that condition?
(3) How should the RESOURCES of the force be applied to accomplish that sequence of actions?
[FM 100-5, Operations, 1986, 10, author emphasis added]

Time-space-force relationships lie at the crux of all the questions the operational artist must answer. The operational artist desires to generate "synchronized" effects (CONDITIONS) through the optimal combination of RESOURCES, at the right time, in the right place, in the right SEQUENCE. This act of "synchronizing" resources at the operational level ought to be a highly developed concept in our current doctrine.

As defined on page 17, FM 100-5,

> Synchronization is the arrangement of battlefield activities in time, space, and purpose to produce maximum relative combat power at the decisive point. [It] is both a process and a result. Commanders synchronize activities; they thereby produce synchronized operations [17].

This definition may be suitable for tactical doctrine. Certainly the tactical commander tries to bring together the effects of actions at a single decisive point. Even Clausewitz echoes the FM 100-5 concept as he states that force "...employment will be more effective the more everything can be concentrated [in] a single action at a single moment [1984,209]." But the modern operational artist may not be able to concentrate his massive combat power at a single point in time and space. Does that mean this commander's tool, synchronization, does not have the depth required of an operational concept?

The upcoming revision of FM 100-5 provides an opportunity to review the concept of synchronization and address it's operational aspects. This paper strives for a more holistic understanding of this important concept for the operational artist.

The author will first set the stage. Some definitions and assumptions will shape the operational artist's environment. The author will then investigate theoretical concepts, such as operational elements of design, to form a basis for the concept of operational synchronization. Then doctrinal literature such as JCS Pub. 1, Department of Defense Dictionary of Military and Associated Terms, JCS Pub 2, Unified Action Armed Forces (UNAAF), JCS Pub. 3-0, Doctrine for Joint

Operations (Final Draft, 1999), FM 100-5, FM 100-15, Corps Operations, and TRADOC Pamphlet 11-9, Blueprint for the Battlefield (Draft), will be reviewed to gain an understanding of the historical development of the concept.

Six criteria that emerge from this investigation will be used to analyze the concept of operational synchronization. The first five criteria emerge from research into the theoretical aspects of synchronization. They include time-medium-force windows of effects, operational objectives, sequencing, economy of force, and flexibility. The sixth criteria, future-orientation, is drawn from a historical review of doctrine.

These criteria will be used to analyze the present concept of synchronization to see if it is useful to the operational artist. The results of this doctrinal examination will be used to suggest some refinements to the concept of operational synchronization and demonstrate it using a synchronization planning methodology. The author will conclude with some implications for the development of the concept of operational synchronization.

The Theoretical Basis for Synchronization

This section provides the theoretical linkages for the concept of operational synchronization. The author will first provide a basic framework of assumptions and definitions. Then several aspects of theory will be investigated to arrive at five evaluation criteria that will be used in later analysis.

There are several key assumptions for this paper. First, the author assumes that an interdependent hierarchy of doctrine exists. JCS publications outline the overall doctrine for the use of the military element of power. Army doctrine is a component of and is subsumed by JCS doctrine. Therefore, Army concepts should reflect JCS doctrine and doctrine specific to Army roles and missions.

Next, the author assumes the operational artist can work in any of the three general states of the operational continuum. JCS 3-0 defines these states as

> PEACETIME COMPETITION: ...political, economic, informational, and military measures short of U.S. combat operations of active support to warring parties, are employed to achieve national objectives...[I-4];

CONFLICT: ...armed struggle...between organized parties within a nation or between nations in order to achieve limited political or military objectives...[1-4-5];

WAR: ...sustained armed conflict between nations or organized groups within a nation involving regular and irregular forces in a series of connected battles and campaigns to achieve vital national objectives...[1-5]

To be of use as a valid doctrinal concept, operational synchronization should apply across this entire continuum. For this discussion, the author assumes the operational artist works in an area of operations that contains opposing forces functioning in all three general states of the operational continuum.

Next, the definition of operational art should also apply in all the general states of the operational continuum. Therefore, the author modifies the JCS Pub. 3-0 definition to read that operational art is

...the employment of [political, economic, social, informational, and] military [elements of power] to attain strategic goals in a [designated geographic area] through the design, organization, and[/or] conduct of [national policy,] campaigns and major operations. Operational art translates strategy into operational, [and in the case of the use of military forces], tactical actions. The operational artist may be a civilian or a military person. No specific level of command is concerned with the operational art [1993, p. viii; brackets show author adjustments to the definition].

The author assumes for this discussion that the operational artist is a military commander, operating in a designated area of operations (AO).

The operational artist's role is to impose his will on the enemy by

...set[ting] favorable terms for [execution of national policy, campaigns, major operations, and/or] battles by synchronized [space,] air, sea, ground maneuver[EW, psyops, and civil-military actions,] ..., [to] affect the enemy throughout the [designated geographic area]...to the greatest advantage of the friendly forces...[with the overall aim of accomplishing strategic objectives] [FM 100-5, 1986, 28, 30; author adjustments are bracketed].

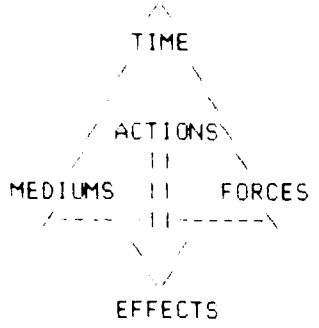


Figure 1. Basic Time-Mediums-Forces Actions Effects (TMFAE) Paradigm

Key definitions for time, effects, mediums, and forces also require discussion. First, time can represent an instant, a block, or a measure of the total period required to complete a campaign.

Next, the operational artist works in various mediums. From the 1974 edition of The Merriam-Webster Dictionary, a medium is a surrounding or enveloping substance; a channel of communication; a means of disseminating ideas; or a condition in which something may function or flourish [435]. James Greer, a current SAMS student, proposes that the commander must be concerned with space, air, land, sea, electronic warfare (EW), and psychological mediums [SAMS student seminar on synchronization, 6 & 9 March 1990. Referred to from now on as SAMS-S3, 1990].

Synchronization processes and results should be approached within a holistic framework of actions and effects. Several assumptions should be kept in mind. First, forces can perform certain actions, deeds, things that are done. Next, a force produces an action that has a separate and distinct effect. Also, one must assume the effect can be measured. Finally, one must assume that the operational artist and/or his staff can synchronize actions and/or effects.

Two types of actions merit attention. Units perform actions such as attack and defense at the strategic, operational, and tactical levels. Elements of units also perform functions such as sustainment, maneuver, planning, and air defense at all levels. Both actions and functions need to be meshed together both vertically and horizontally, in planning and execution, to effectively synchronize the campaign plan.

Air, sea, land, special operations forces, and civil agencies act to generate effects in mediums. Force potential and effects are measured as combat power, "...the ability to fight...[,]...the effect created by combining maneuver, firepower, protection, and leadership in combat actions against the enemy in war [FM 100-5,1986,11]." Effects are also consequences, outcomes, results, or products [Webster,1974,232]. Effects do not necessarily have to occur at the same time or in the same place as the forces and/or actions that generate them. Effects can also change over time and move between mediums. Finally, actions in one medium can cause effects in another medium [Greer,SAMS-S3 1990].

Effects can accrue to the benefit or detriment of both combatants. Effects can occur in any one or more of the moral, physical, or cybernetic domains. One

cannot conclude that a positive effect for one combatant means a concomitant negative effect for his opponent. However, one can, to some extent, predict the future type and magnitude of effects.

Coordination, synergism, and synchronization also require definition. Since these terms are not defined in JCS Pub. 1, the author offers composite definitions from The Merriam-Webster Dictionary, 1974.

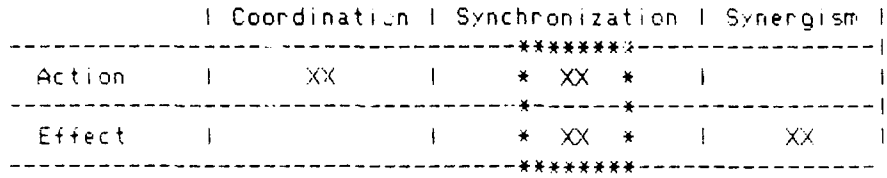


Figure 2. Actions and Effects as parts of Coordination, Synchronization, and Synergism

Coordination can be described as the ACT or PROCESS of causing actions or forces to work together to attain an agreeable or harmonious effect [23,163,167,325]. The individual effects may lose their independent nature but the resultant effect will not be greater than the sum of the effects acting independently. This concept is neither time nor space dependent. One can coordinate sequential or simultaneous actions, throughout the depth of a geographic area. Coordination MAY, but not necessarily will, result in synchronized actions/effects and/or synergistic effects.

The definition of synchronization has two components. It is the act or process of arranging, representing, or causing ACTIONS and/or EFFECTS to occur at the appropriate time. This connotates a high degree of coordination. It also alludes to a high degree of harmonizing or blending of effects. Both actions and their resultant effects MAY take place concurrently, but this is not necessary [Webster, 1974, 693-4,1583]. Once again, individual effects may lose their independent nature but the resultant effect will not be greater than the sum of the effects acting independently. It is time, but not space dependent. The current FM 100-5 definition of synchronization advises commanders to produce synchronized actions that cause synchronized effects at decisive places and times, in accordance with a stated purpose.

Synergism is defined as the joint EFFECT or result of discrete acts that are greater than the sum of individual parts acting independently [Webster, 1974, 694]. In essence, effects reinforce and complement each other to

produce effects that are greater than the simple sum of the individual effects acting independently. This resultant effect is time dependent, but not space dependent. Synergistic effects are the most desirable effects that a commander tries to generate. The operational artist seeks to coordinate with forces to produce synchronized actions that produce synergistic effects.

Given these ground rules, one can develop four hypotheses regarding synchronization. The operational artist synchronizes: (1) actions; (2) effects; (3) actions and effects; (4) neither actions nor effects. Hypothesis (4) needs no further consideration if one believes the above assumptions to be valid. Next, it is safe to say that it is easier to synchronize actions than effects. The operational artist can probably control actions more effectively than he can effects. Therefore, hypothesis (1) would appear to be the conservative route to take in the synchronization issue. The concept of synchronization in the current FM 100-5, at first glance, appears to go this route. But the heart of the issue is not the action performed, but the effect produced. However, if one only focuses on synchronizing effects, one ignores the actions which produce the effects. Therefore hypothesis (2) yields only a partial solution also. That leaves hypothesis (3), that one synchronizes actions and effects. In actuality, the hypothesis should read that one coordinates and synchronizes actions that produce synchronized, hopefully synergistic effects.

The operational artist's organization produces these synergistic effects through the command and control of economic, political, social, geographic, informational, and military elements of power. The operational artist's organization is a "system of systems". In the holistic sense, the system creates effects at times and in locations of the operational artist's choosing. Subordinate units are interdependent parts of the overall system. These units are "nested" systems, that is, systems within systems [ACAM, 1988, 3-2]. Air, land, sea, and special operations forces, and civilian agencies, should be organized into nested, cohesive systems within the operational artist's joint and combined military organization.

The operational artist uses resources at his disposal to solve Johnston's basic problem of war, " ..to obtain: unity in the application of [elements of] power through the control of movement of secure mass to obtain an objective [Johnston, 1934, 118]." The operational artist seeks to impose his will on the opposing force at the minimum ethical, economic, and military costs

[Fuller, 1925, 154]. He receives his strategic guidance, then derives an operational end state and a vision for the overall accomplishment of the campaign objectives.

To do this, Clausewitz argues that the operational artist should focus all his efforts at seeking out and destroying the opponent's "center of gravity," the "hub of all power and movement, upon which everything depends [1976, 595-6]." Clausewitz advises the operational artist to continuously analyze the dominant characteristics of the opposing forces to ascertain this center of power [1976, 485, 595-6]. The author believes this center of gravity may be a physical force such as a large troop concentration or a moral factor such as legitimacy.

J.F.C. Fuller, in his 1925 book entitled The Foundations of the Science of War, offers a similar view. Fuller advises the operational artist to focus on destruction of the opposing force's plan [157]. Fuller's recommends aiming at a vital component, similar to Clausewitz's center of gravity. Loss of these vital components unhinges the enemy and cause irrevocable deterioration in cohesion and effectiveness, invariably leaving the enemy highly vulnerable. As FM 100-5 suggests, a single vital component may be the enemy force itself [1986, 179]. additionally, there may be more than one vital component.

Some actions/effects bring about necessary and favorable conditions for the execution of subsequent operations. For example, the enemy will generally protect his vital components. This will cause the operational artist to first uncover the vital components, then attack them directly. If this is the case, the best way to attack may be in an indirect fashion, by locating vulnerabilities and exploiting them. In this sequenced attack, the commander will cause his forces to act such that their synergistic effects will locate and exploit a key vulnerability and, in turn, thereby expose a vital component to attack. Fuller recommends this indirect approach, with the initial focus on lines of operation that aim the main effort at an assailable component, a decisive point, a key vulnerability through which the vital component can be affected [158, 277].

Often, the operational artist may not be able to arrive at the military end state in a single operation due to the high cost in resources [SAMS,3]. Therefore, the other key element in sequencing operations arises from the concept of culmination, evidenced in culminating points, transitions, and operational pauses. These concepts provide good examples of the effects of operational synergism.

Mutual effects of the interaction of forces cause a change in the combat power each can wield. At some point the ratio of combat power can change radically in favor of one combatant or the other. Clausewitz describes the culminating point for the defender as the point at which the defender must make up his mind to act before the effects of losses preclude him from doing so [1976, 383]. He defines the attacker's culminating point as that point where the attacker has just enough strength remaining to maintain a defense and wait for peace [1976, 527].

Attrition of combat power and extension of lines of communication may dictate an operational pause for reorganization in order to maintain operational momentum [SAMS, 3]. The operational pause is defined by Clausewitz as a period of waiting for a better moment, observation, or rest and resupply [1976, 219, 524]. Clausewitz implies that operational offenses cannot be completed in one movement, therefore rest periods are needed in which effects from utilization of logistics assets can be overcome in order to continue actions. Also, the defender may not be able to attack until he builds sufficient combat power and/or causes a decrease in the opponent's combat power.

The operational artist must simultaneously attack his opponent's center of gravity while protecting his own [SAMS, 3]. Proper recognition of this drives sustainment and operational considerations in the application of synchronized effects. Sustainment affects operational synchronization by governing what can and cannot be accomplished. Bolt and Jablonsky point out in a recent Military Review article that operational synchronization is infinitely more complex particularly due to increased sustainment considerations including an expanded area of support (ratio of supported to supporting increases, resupply times increase); high consumption rates; and extended lines of support (which creates a vulnerability) [1987, 10].

Sustainment considerations also affect the manner in which forces can deliver effects. Sustainment synchronization may entail building potential combat power through establishment of a forward base of support that is connected to the national resourcing base. As operations extend into time and space, additional forward bases may be required to give forces the ability to project their combat power and effects. This consideration may drive the operational artist to dictate securing intermediate objectives in order to provide these intermediate operating bases [SAMS, 10-11].

The operational artist should also use simultaneous actions to gain possible synergistic effects. Clausewitz illustrates the concepts of simultaneous and sequential or successive actions as he says

> ...all forces intended and available for a strategic purpose should be applied simultaneously...concentrated in a single action at a single moment. That does not mean that successive efforts and sustained effects have no place in strategy. They cannot be ignored, the less so since they form one of the principle means toward a final success: the continuous deployment of new forces. [1976, 209]

Other theorists share a mutual understanding of the concepts of simultaneous and sequential operations. The Russian military thinker Tukhachevsky shared this understanding as he said, "...form and deploy...so that by a combination of united and special [simultaneous] efforts [one] can initially destroy these elements of the defense and subsequently proceed with the overall destruction of the defense [1931, 23]." Furthermore, actions can be sequenced such that movements place forces in an area that may influence the enemy's defeat [Tukhachevsky, 1931, 24].

The operational artist seeks a properly blended combination of sequential and simultaneous actions that produce synchronized, synergistic effects. The overall sequence of operations in the campaign may be deployment, build up of a base of operations, offensive, exploitation, consolidation, and finally internal development and support. Within this overall sequence each designated force sequences its own activities to achieve effects on objectives. Actions of all forces may take place simultaneously. For example, air forces may be involved in gaining air superiority. At the same time air and sea forces may be deploying land and special forces to the AO. Civilian agencies could also be coordinating internal political and economic support and providing, along with special operations forces, intelligence to the operational artist.

Clausewitz said, "The best strategy is to always be very strong; first in general, and then at the decisive point [1976 204]. By strength Clausewitz referred to concentration of forces. But in his day the effects generated by ground forces were felt in the immediate vicinity of the enemy. Therefore the forces and effects were in the same general locality. The operational artist's forces are widely dispersed on today's battlefield. Therefore the current concept of operational synchronization should include a more widely dispersed perspective of effects.

JFC Fuller addressed simultaneous and sequential actions, and economy of force, when he said

> A plan of a campaign demands a definite object...and this object, in its turn, demands a series of moves each demanding an objective of its own....
> To attain both primary and secondary objectives, a series of subsidiary objectives may have to be gained, and possibly also in order to weaken the enemy at the point of attack, it may be necessary to institute certain tactical operations, which can only be considered of value if they reduce the enemy's fighting power at the decisive point of attack to a greater extent than our own. [1925, 156-7]

This idea impacts on concepts regarding the distribution of forces. These concepts include concentration and economy of force. Forces must be applied such that the effects from their actions should be felt in some concentrated fashion at the time and place of the operational artist's choosing. Note that it is not necessary that the forces themselves be concentrated, only their effects. Effects should be distributed over time and space such that no effect is wasted. Therefore, minimum amounts of effects are applied in areas other than the main effort. Also, since there are never an infinite amount of resources, the commander must economize, achieving minimum necessary effects in most areas while massing the bulk of his force's concentrated effects at a particular point. Consequently, the greatest holistic effect is generated by concentration of the majority of effects over time in the main effort, integrated with minimum necessary effects directed at all enemy forces and points in space other than the main effort.

The essence of the idea of operational synchronization is to apply forces in actions such that their concentrated, synergistic effects are felt at the right time and place. But the operational commander cannot guarantee this precision at his level.

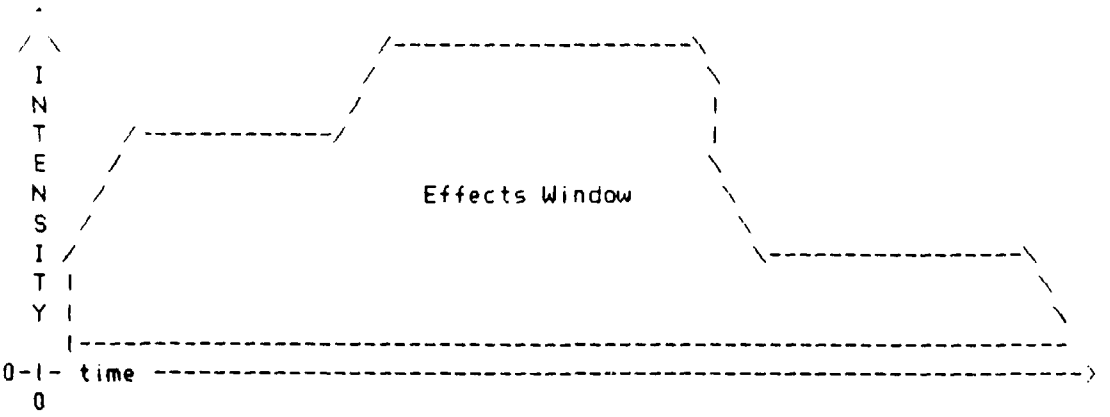


Figure 3. Effects Window over Time

Hugh Hoffman, a current SAMS student, proposes that most likely the actions of a particular force will create a "window of effects" that will vary in "shape" due to many factors [SAMS-S3, 1990]. This happens for two main reasons. First, the effects themselves last more than just an instant. They change over time, creating windows of effects. Second, it is difficult to predict the exact intensity of these windows of effects in time and space.

Synchronization would be easier to accomplish if the enemy did not act independently. But the enemy has a mind of his own. Although the enemy may be affected by friendly effects, there is no guarantee that he will act as the friendly commander wishes him to. Therefore all actions and effects must be considered relative to the power the enemy can bring to bear, his vital components, and the nature of the mediums in the operational artist's designated geographic area.

Additionally, the presence of friction drives the need for flexibility in developing synergistic effects. Tukhachevsky warns that one must be prepared to "...overcome a mass of all kinds of unforeseen complications and frictions...and should be prepared for drastic changes in a situation and occasionally radical reorganization of a permanently drawn plan [1931, 24, 26]." Fuller describes this flexibility as "elasticity." He states, "...the framework of every plan must be extremely elastic, since conditions are always changing, and our knowledge of them is so limited that a large margin must be left over for the unexpected...[1925, 261]."

This leads to the concept of branches and sequels. The operational artist balances short and long term operational requirements by considering the campaign both in its entirety, and by phases. The commander anticipates changes in conditions and develops branches to plans that counter possible enemy reactions. Sequels address missions based on outcomes of friendly actions. Preparation for possible sequels often has a major impact on the overall plan. For example, an option that maximizes effects for deployment may be rejected due to possible sequels that could occur in the follow-on phase [SAMS, 4]. Planning for branches and sequels also contributes to the agility of the force by reducing reaction time to changing conditions.

Based on a review of theoretical concepts, five criteria emerge that focus on the essence of operational synchronization. First, the concept should include the notion of "time-medium-force windows of effects," generated in one or more mediums, with their resultant effects being felt in one or more mediums. Second,

the operational synchronization concept should address operational objectives. Third, the concept should address sequential and simultaneous actions and/or effects. Fourth, the synchronization concept should address concentration of effects through the use of the principle of economy of force. Fifth, operational synchronization must deal with uncertainty.

Historical Development of Synchronization as a Doctrinal Concept

> ...[D]octrine must tell the soldiers of today how to fight tomorrow with weapons designed yesterday, against enemies we must presume under conditions which are difficult to imagine to achieve purposes of a shifting national strategy in an environment of rapid technical change, scant resources, and other murky variables.
> [Wass de Czega, 1984, 105]

Huba Wass de Czega, an influential FM 100-5 doctrine writer, also focused on several specific areas of doctrine that are germane to the issue of operational synchronization. U.S. doctrine should emphasize thorough integration of all the tools of battle and it should recognize the constraints that logistics places on operations. He also pointed out that doctrine must be adaptable to operations anywhere in the world. Finally, doctrine should provide a direction for change, keeping pace and ideally anticipating changes [Wass de Czega,1984,105,107-8].

Other doctrinal missions relate to the concept of synchronization. Doctrine should be authoritative, not descriptive. It should be a guide for action, requiring judgment in execution; and it should be flexible, adaptive to new realities, and forward-looking. It should also cover all possible uses of military power and provide a conceptual framework for how the Army handles operations in all the general states of the operational continuum. U.S. Army doctrine should also provide some linkage to the JCS, the NCA, and the political decision making process. [Twomey, 1989].

TRADOC has several standards for doctrine development. Doctrinal products must be: consistent with FM 100-5, FM 100-1 The Army, and FM 101-5-1 Operational Terms and Graphics; written in concise, understandable terms; written to encourage initiative on the part of leaders and subordinates; integrated vertically two echelons above and two echelons below the target echelon; integrated horizontally across mission areas and branches; and be consistent with applicable interservice and international agreements and publications [TRADOC, 1987, 1]. Using these guidelines, the author searched JCS and Army

doctrine to find evidence of the historical development of operational synchronization.

Research into three JCS manuals reveals little or no evidence of the concept of operational synchronization. The author first looked in versions of JCS Pub. 1, Dictionary of United States Military Terms for Joint Usage from 1959 through the current 1987 edition (with change 1, dtd 1988). Research indicates there was no serious consideration of operational synchronization until 1988. Previous editions (1959, 1972, 1974, 1984, 1986, and the original 1987 edition) do address strategy, tactics, and operations (as military actions not connected to levels of war). There is also some evidence of development of the elements of operational design and the process of campaign planning. But a sound definition of the operational level of war does not appear until the 1988 change to the 1987 edition [2]. Futhermore, one can not find a definition of "synchronization" in any edition.

The definitions of campaign and campaign plan in JCS Pub. 1 (1959) suggest ideas that are connected to the concept of synchronization. For example, The 1959 edition defines a campaign as "...a SERIES of related military operations aimed to accomplish a COMMON OBJECTIVE, normally within a given TIME AND SPACE [26,author emphasis added]." A campaign plan is defined as "...a BROAD PLAN to accomplish a long range major STRATEGIC OBJECTIVE, usually divided into a SERIES OF RELATED MILITARY OPERATIONS [26, author emphasis added]." Both definitions suggest operational objectives; phasing; simultaneous and sequential actions; and linkages to time, space and forces.

The term "phase" is also defined in previous editions. The 1959 edition of JCS Pub. 1 defines a phase as, "...a step in the operation at the end of which a reorganization of forces may be required and another action initiated....[C]ertain phases may overlap in a point in time,...[but they usually occur in order...[102]." This early concept of phasing is never linked with effects generation or time-mediums-forces considerations. Furthermore, phasing disappears as a definition from the 1987-8 manual.

The most recent JCS Pub. 1 (change 1, dated 1988) defines the operational level of war as

> The level of war at which campaigns and major operations are planned, conducted, and sustained to accomplish strategic objectives within theaters or areas of operations. ACTIVITIES at this level LINK TACTICS and STRATEGY by ESTABLISHING OPERATIONAL OBJECTIVES needed to

> accomplish the STRATEGIC OBJECTIVES, SEQUENCING EVENTS to achieve the operational objectives, initiating actions and APPLYING RESOURCES to bring about and SUSTAIN these events. These activities imply a BROADER DIMENSION OF TIME OR SPACE than do tactics; they ensure the logistic and administrative support of tactical forces, and provide the means by which tactical successes are exploited to achieve strategic objectives [2, author emphasis added].

One can readily see the operational elements of design in this definition. But there is no solid link of actions and effects. Finally, no versions of JCS Pub. 1 define anything closely related to synchronization in any editions, including the most current JCS Pub. 1.

Editions of JCS Pub. 2, UNAAF, and JCS Pub. 3-0 contain little or no mention of operational concepts and no mention of operational synchronization. Even the campaign plan, the document now recognized by JCS Pub. 3-0 as the operational artist's synchronization tool, was deleted from the most recent 1986 edition of the UNAAF.

The short discussion on synchronization in JCS Pub. 3-0 (1988) addresses some of the elements of operational design, but never discusses the concept of synchronization in depth [III-4-6]. The manual states that the campaign plan synchronizes actions of the land, sea, air, and special operations forces in land, sea, air, and space efforts [III-6]. Sustainment considerations are also mentioned, including establishment of a national sustaining base, forward sustaining bases, and intermediate bases of operations to support phasing; opening and maintaining LOCs; and establishment of priorities.

JCS Pub. 3-0 also contains a campaign plan format similar to the one formerly printed in the UNAAF. This format lists time, and phasing as considerations for the operational artist. But the manual never discusses synchronization in depth. Therefore, a review of past and present versions of the three most important JCS manuals does not provide any concrete guidance for the development of a JCS or an Army version of the concept of operational synchronization.

Examination of editions of Army Field Service Regulations (FSRs), versions of FM 100-5, and FM 100-15, Larger Units, provides some insight into the historical development of operational synchronization. The author traced the development of the synchronization concept in U.S. Army doctrine from 1939 to the present. He began with Tentative FSR, Operations: FM 100-5, dated 1939. This is the earliest modern equivalent of the current FM 100-5. It serves as a starting point for the umbrella concept of Army doctrine.

The seeds of the elements of operational design and the concept of synchronization are found in several places in this early FM 100-5. First, the manual suggests the concept of synchronization as the manual states, "CONCENTRATION of superior forces both on the ground and in the air, AT THE DECISIVE POINT AND TIME, creates the CONDITION most essential to decisive victory and constitutes the best evidence of superior leadership [27,author emphasis added]." FM 100-5 talks about sequencing as it states, "...every...battle involves certain PHASES, which follow in a natural SEQUENCE [136, author emphasis added]." Several other related concepts to synchronization are mentioned such as maintenance of economy of force in one area in order to concentrate in another decisive location, the influence of fog and friction, analysis of opposing lines of action, maintenance of freedom of action, the effect of the human element in battle, and the necessity for proper timing in the use of reserves and fires [27-8,133-7]. But there is no specific mention of operational art or synchronization.

Editions of FSR: FM 100-5, dated 1941, 1944, and 1954 showed no substantial changes from the 1939 edition. The 1941 edition hinted at synchronization, advising that, "...integration of an attack into a unified whole requires COMPLETE COOPERATION AND COORDINATION prior and during operations...[111]". The 1944 edition suggested sequenced operations when it stated that air superiority was necessary prior to launching ground operations [23]. The FSR: FM 100-5 (1954) recommended the efforts of all components be directed toward the same general objective under one commander. It also advised that one major key to success was the concentration of superior combat power in the form of firepower and maneuver at the decisive place and time, similar to the current concept [6,75].

FM 100-5's 1962 and 1976 versions were landmark editions. The 1962 manual revealed several new concepts including ideas about linkage of national policies to military action; definitions of the spectrum of conflict and military power; discussions of combat power, interdiction, vulnerabilities and risks; and a discussion of the operational environment (defined in geographic, national objective and security considerations, characteristics of the indigenous population, and missions and resources of the armed forces of the opposing sides) [3-6, 15, 48-50]. These concepts later contributed to the development of operational art and operational synchronization. The 1976 edition likewise introduced major changes to Army tactical doctrine. But one of its authors,

General William Depuy, admitted to Paul Herbert that the 1976 version did not address operational level considerations [1988, 97].

Several concepts were introduced in the 1982 edition of FM 100-5, including the three levels of war, AirLand Battle, and the definition of the operational level of war. Synchronization actually first appears as a concept in the 1982 version of FM 100-5 [2-3]. The actual term "synchronization" is also used for the first time. This edition defined the term, saying

> ...synchronization means more than coordinated action. It results from an all-pervading unity of effort throughout the force. There can be no waste. Every action flows from the higher commander's concept. Synchronized, violent execution is the essence of decisive combat. SYNCHRONIZED OPERATIONS COMPLEMENT AND REINFORCE EACH OTHER, GREATLY MAGNIFYING THEIR INDIVIDUAL EFFECTS [2-3, author emphasis added].

Former TRADOC commander General Don Starry's 1982 central battle concept influenced 1982 operational thinking and operational synchronization. The manual began to discuss things like seeing and operating deep; integrated interdiction that could SET THE TERMS OF THE BATTLE; "windows of action;" and shaping the central battle in terms of time, space, and desired enemy force configurations [Romjue; 1984; 23, 26-7, 32-3].

John Romjue feels FM 100-5 (1982) made synchronization indispensable, the essence of decisive combat. He feels it grew to become more than a cliche about coordinated action. It implied a constant grasp of the situation and the higher commander's plan. It meant the fullest use of combined arms to achieve complementary and reinforcing effects [Romjue, 1984, 68]. Success and failure at the tactical level, when viewed as a whole by the operational commander, became the basis for a wider scheme of maneuver. The operational level commander's mission evolved to gaining positional advantage over the enemy and indirect leverage by exploiting effects of tactical actions wedded to a sound operational campaign plan. Synchronization then came to imply management of the effects of multiple tactical actions [Romjue, 1984, 110-12].

The concept of synchronization was further refined in an an Army magazine article written by William Depuy [Romjue, 1984, 57]. DePuy described the Army as a group of parallel, multi-echeloned, vertically and horizontally integrated, functional nested systems, that act to produce effects [1984, 20-1]. DePuy stated

> It is the horizontal synchronization of these actions, which concentrates combat power in controlled burst of intensity, that wins battles to which each of these elements have been conveyed by maneuver. Synchronization is the responsibility of the maneuver commander [1984, 21].

DePuy also discussed some other items that impact on synchronization. He suggested the intensity of synchronization was based on time available prior to action, the commander's decision on how much was needed, required precision, and the amount of effort and resources needed to gain synchronized action [1984, 21-5]. He also suggested that high precision synchronization was desired, characteristic of lower echelons, and was both vital and achievable at squad through battalion level [1984, 24-5].

Depuy also asserted that although perfect synchronization was the design goal, the ability to achieve perfect synchronization decreased as the scope of operations expanded [DePuy, 1984, 24]. As one went higher into echelons both the ability to achieve precise, synchronized effects, and the necessity to gain the exact, right effects at a certain time and place were reduced. Therefore, DePuy suggested that precise synchronization was both desirable and achievable at lower tactical levels, and less achievable but not required in such a precise fashion as one moved toward operational level formations [1984, 21-5].

Finally, Depuy's 1984 article introduced the concept of "dynamic synchronization." He felt synchronization was a concept that assisted in maximizing relative advantage over the enemy [21]. The commander continuously searched for relative advantage, and considered how to synchronize effects of unit actions as he developed his concept of operation and scheme of maneuver in a dynamic environment [21]. The staff further elaborated and scheduled actions in time and space [23]. This all led to the notion of continuous, intelligent, adaptive synchronization which enabled the commander to act within the context of a flexible operational concept despite errors, surprise, and misfortunes [23]. This article made a significant contribution to the concept of operational synchronization.

Synchronization was refined to its current form in the 1986 edition of FM 100-5. The 1986 edition of FM 100-5 now emphasizes mastery of time-space relationships; the interaction of opposing forces in ground, air, and sea maneuver; rapid, successive concentrations; phasing; setting the terms of battle; and unambiguous unity of purpose throughout the force [17, 18, 28-30]. This current concept will be reviewed in detail later in the discussion.

The author also reviewed FM 100-15, Large Unit Operations, including the editions of 1942, 1950, 1963, 1968, 1987 (FM 100-6, Coordinating Draft), and the 1989 version of FM 100-15, (now entitled Corps Operations). Early versions contained some key elements related to operational synchronization. But these concepts also faded away as FM 100-15 evolved to its current tactically-oriented form.

FM 100-15 (dated 1942) contained several key elements of operational design which are repeated in editions through the late '60s. It emphasized rapid concentration of forces (not effects) in a decisive direction [10] and contemplation of probable successive operations to exploit initial success, as well as for actions to be taken in case results are other than those hoped for [10]. It advised army commanders to project themselves days and weeks into the future as they visualize the campaign as a whole [10]. The 1942 edition also advised the commander to link political and military objectives [12]; and use terrain, surprise, and concentration of forces at decisive points to secure and retain the initiative [11]. FM 100-15 (dated 1942) also discussed phasing, advising that attainment of an objective may require a selection of a series of objectives that are seized in sequence [12], in conjunction with the achievement of air superiority, deception and force protection operations [17-18]. Attainment of these objectives could be gained through direct and/or indirect ways [13]. The 1963 edition defined a phase as a distinct period of activity at the end of which (1) reorganization or regrouping is needed; (2) a major adjustment in logistical support is required, or (3) there is a change in the nature of the operation [24]. FM 100-15 (dated 1942) also emphasized time and space considerations. Planners were advised to consider time and space factors linked to all actions of friendly and enemy forces, use of reserves, logistical considerations, effects of aviation and artillery support, and many other considerations [19-25, 33, 51-56].

In the early 1980s, FM 100-15 took on a tactical flavor. Time and space considerations were addressed [4-1,2], but no definition or discussion of synchronization was proffered and corps operations were discussed using tactical battlefield operating systems (BOS). FM 100-6 (Coordinating Draft) picked up FM 100-15's operational flavor. But FM 100-6 was never approved and published as official doctrine, despite its wealth of information on operational issues.

Although not official Army doctrine, the 1989 TRADOC Pamphlet 11-9, Blueprint of the Battlefield (Draft), contains some interesting insights on

synchronization. Synchronization is developed first as an umbrella concept, then an operational concept.

First, as stated in TRADOC Pam 11-9, synchronization is found within the command and control "system of systems" as evidenced by its inclusion as a subtask of operational command and control [5-19, C-18]. Each command and control system is horizontally linked within its own level and vertically linked to higher and lower levels, causing a "system of systems" or nested systems architecture [2-7,8]. Within this nested systems concept, parts of the overall concept of synchronization surface at each level of war. For example, at the strategic level initiatives are sequenced to provide adequate means to the operational commander in order to accomplish operational ends. Operational commanders integrate air, land, sea, and space forces into campaign and major operations plans, thereby providing guidance for tactical commanders. Tactical commanders synchronize tactical formations in battles and engagements [2-9].

Synchronization is specifically found in the "Direct and Lead Subordinates" subtask of the operational operating system (OOS) entitled "Command and Control" [C-17]. Within that subtask, synchronization is specifically defined as

> [the arrangement] of land, air, and sea operational forces in time and space and purpose to produce maximum relative combat power at the decisive point. It includes the vertical integration of functions within each operating system and the horizontal integration of the function across operating systems in time and space to maximize combat output. Synchronization is the function that ensures that all elements of the operational forces are efficiently employed to maximize the sum of their effects beyond the sum of their individual capabilities [C-18].

Although TRADOC Pam 11-9's purpose is only to provide a framework for combat developments analysis, it is beginning to gain credibility as a doctrinal manual. Even so, it still fails to deal adequately with the concept of operational synchronization. The author's impression is that TRADOC Pam 11-9's operational synchronization concept is simply tactical synchronization on a larger scale. The concept defined in this manner disregards the size of the operational commander's designated geographic area and the ability of effects to be felt in widely different times, geographic areas, and mediums. But TRADOC Pam 11-9 has taken a step in the right direction, toward the evolutionary development of the Army's concept of operational synchronization.

An additional word concerning the future environment is needed. General Vuono suggests fewer U.S. forces will be forward-deployed and Army forces will

have to be able to respond to any global contingencies [1990,13]. The Army Times provides a compass direction for future doctrine in a recent article. It demonstrates the push of doctrine in a joint direction through the publication of two new field manuals. First, Doctrine for Unified and Joint Operations will outline the role of a major commander in peacetime and in war. Next, Doctrine for Joint Operations in Low Intensity Conflict will describe the relationship between the head of a U.S. command and other federal agencies, primarily the State Department, in small wars. These manuals reaffirm the dominance of the U.S. embassy and advise the commander that he must be aware of political and economic forces [1990, 27-8].

Even the recent FM 100-20/AFP 3-20, Military Operations in Low Intensity Conflict (Approved Final Draft) dated 1989 states that the operational commander "...must synchronize the use of the military instrument with other agencies employing other instruments of national power in order to design programs which employ a unity of effort [1-13]." This new manual shows the need for application of the operational art in areas where military forces will have to work closely with civilian agencies. This also suggests that the concept of synchronization may involve shaping the effects of not only military elements of power, but also civil and governmental agencies.

Three major observations emerge from the author's research into the doctrinal development of operational synchronization. First, the emergence of the concept of operational synchronization is tied directly to the emergence of operational art in U.S. Army doctrine. Furthermore, clarification of the concept of operational synchronization in JCS doctrine falls an intellectual step behind the development of operational art in Army doctrine. Second, doctrinal writers tend to define operational synchronization by expanding tactical concepts. The author's experience is that this mindset gets in the way of understanding the true nature of operational synchronization.

Third, JCS manuals, FM 100-5, FM 100-15, and FM 100-20 appear to be taking divergent paths. JCS manuals appear to provide an umbrella concept at the DoD level. FM 100-15 turns toward tactical issues. FM 100-6 was never published, leaving a gap in doctrinal guidance at the operational level. FM 100-20, by its joint affiliation with the Air Force and the comprehensive problem it treats, touches on the strategic, operational, and tactical levels. FM 100-5 is at the crossroads. Which path will it take as a result of its revision?

The task here is to analyze the Army's current concept and, if any shortfalls exist, revise them in the next version of FM 100-5. This historical review suggests many criteria similar to that developed from theoretical research. But one additional criterion for evaluation of the current doctrinal concept of operational synchronization surfaces from a review of doctrine. The doctrinal concept must have a future orientation. This means it should be adapted to apply in whatever environment and type of operation the Army finds itself. The synchronization concept should apply across all general states of of the operational spectrum, and even include the conduct of the operational art in environments where two or more general states of the continuum exist simultaneously. The operational synchronization concept should also reflect a more comprehensive, integrated view that includes consideration of the effects that result from all types of military forces and civilian agencies.

Evaluation Criteria

Based on a review of theoretical concepts and historical doctrine, six criteria emerge that focus on the essence of operational synchronization.

First, the operational synchronization concept should include the notion of "time-mediums-force windows of effects." Time includes that measurable period in which actions and effects take place. Time starts for the operational artist when he is given the mission to conduct operations, and continues until the strategic goals are accomplished.

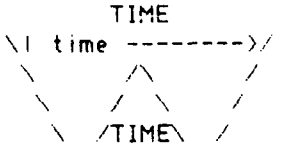
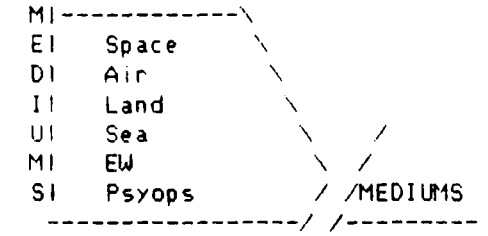


Figure 4a. Time Block, TMFAE Paradigm



The operational artist's environment is divided into space, air, land, sea, EW, and psychological mediums.

Figure 4b. MEDIUMS Block, TMFAE Paradigm

The operational artist has air, land, sea, special operations forces, and civilian agencies available to him.

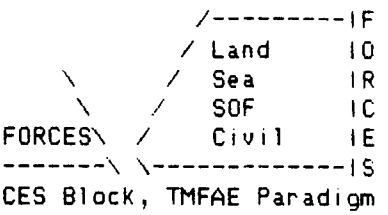


Figure 4c. FORCES Block, TMFAE Paradigm

Effects can accrue in any combination of the moral, physical, and/or mental, domains. Also, effects can occur in multiple mediums and extend over time into several mediums. A particular action creates one or more three dimensional windows of effects. The window begins to form at the point of application of the action, and continues to exist until effects totally dissipate.

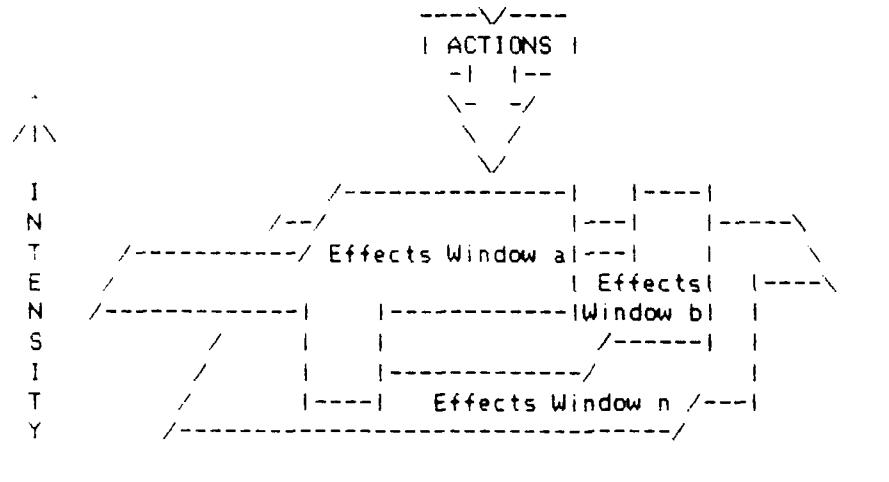


Figure 4d. Multiple Effects Windows, TMFAE Paradigm

The window extends in changing intensity over time and in one or more mediums. One or more windows (a,b,-->n) may appear at several different locations within one or more mediums. These windows of effects of a particular action change over time. Additionally, the windows of effects cross over into different mediums over time. A group of actions are synchronized if their 3-D windows overlap in concert with the commander's guidance. A group of actions produce synergistic effects if their 3-D windows grow as they overlap to form one or more new, larger, windows in time and space. Appendix A contains a complete TMFAE Paradigm.

The next criteria requires the synchronization concept to include operational objectives. The operational artist's plan should be focused on achieving a defined military end state. It should also focus on centers of gravity or vital components.

Next, a concept of operational synchronization should also include the concepts of sequential and simultaneous actions and effects. Sequential actions maintain currently existing synchronized effects and/or produce new windows of effects that appear in the operational artist's AO. Simultaneous actions produce effects that act independently or combine in a synergistic manner. These windows interact with those already present to produce new combinations of synchronized, synergistic effects.

The fourth criteria, economy of force, requires that operational synchronization inculcate the ideas of concentration, mass, and economy of force. Actions should be coordinated and synchronized such that their effects are concentrated in accordance with the commander's desires. Next, effects should be concentrated to produce an overall synergistic effect within an appropriate time period, in a designated area. Finally, no force should be left unused. Actions of forces should be allocated in a manner that effects are produced in, at a minimum, an effective and efficient manner in accordance with the operational artist's desires.

This last statement could lead the reader to believe that there is a maximum level of effects that can be gained from a single action or combination of actions. On the contrary, while there is a maximum limit to the simple sum of effects (synchronized effects), there is theoretically no limit to the intensity or duration of synergistic effects [Greer, SAMS-S3, 1990]. Therefore the operational artist attempts to achieve, at a minimum, a resultant effect equal to the sum of the individual effects (synchronized effects). But the operational artist's goal is a resultant combined effect, which he can predict with some degree of certainty, that exceeds the sum of the individual effects. This resultant synergistic effect has no limit.

The fact that the operational artist cannot measure this synergistic effect limit suggests the next criteria. The operational artist will never be entirely certain of the effects of his actions. He faces an independent enemy, capable of a variety of known and unknown actions. Additionally, chance events degrade actions and their resultant effects. In the author's view, friction is first dealt with by approaching synchronization of effects as a continuous process, labeled by DePuy

as "dynamic synergism." The operational artist also deals with uncertainty and chance through flexibility provided by planning for branches and sequels.

Finally, the doctrinal concept must be future-oriented. It should be applicable in any environment and type of operation. The synchronization concept should apply across all general states of the operational spectrum. It should include the conduct of operational art in environments where two or more general states of conflict exist simultaneously. Furthermore, the operational synchronization concept should reflect a joint and combined perspective that includes consideration of the effects that result from all types of air, land, sea, special operations forces, and civilian agencies.

Analysis of the Current Concept

The evaluation criteria are listed in the matrix below.

CRITERIA	?Meets Criteria? YES	NO	Shortfalls
Time-Medium-Force Effects Windows			
Operational Objectives			
Sequencing of Actions, Effects			
Economy of Force			
Flexibility			
Future-Oriented			

Figure 5. Evaluation Criteria Checklist

This matrix will be used in conjunction with the TMFAE Paradigm to analyze the current version of synchronization found in FM 100-5.

The concept of synchronization should be an integral part of operational art. It is considered by some to be the "heart of the matter." Synchronization is given two major treatments in FM 100-5. First, the general concept of synchronization is addressed as one of the AirLand Battle tenets in Chapter 2, Fundamentals of AirLand Battle Doctrine. Second, synchronization is addressed in its operational context in the beginning of Chapter 3, Operational and Tactical Planning and Execution. Throughout the remainder of this section the author will quote liberally from these sections.

First, review the basic definition.

> Synchronization is the arrangement of battlefield activities in time, space, and purpose to produce maximum relative combat power at the decisive point. [It] is both a process and a result. Commanders synchronize activities; they thereby produce synchronized operations [17].

The first criteria requires that the concept of operational synchronization address actions which create time-medium-force windows of effects. FM 100-5's concept addresses effects, measuring them as combat power ("...the ability to fight...[,]...the effect created by combining maneuver, firepower, protection, and leadership in combat actions against the enemy in war") [11]. But while this passage mentions effects, it concentrates on actions. This is interesting, because while it is important to synchronize actions, the heart of the concept is the synchronization of effects. Note also that this concept focuses on arranging the effects of friendly actions to be concentrated at a single point. This idea is also reflected on the illustration on page 18, shown here at right. This passage also does not address the difficulty of producing synchronized effects at a single point.

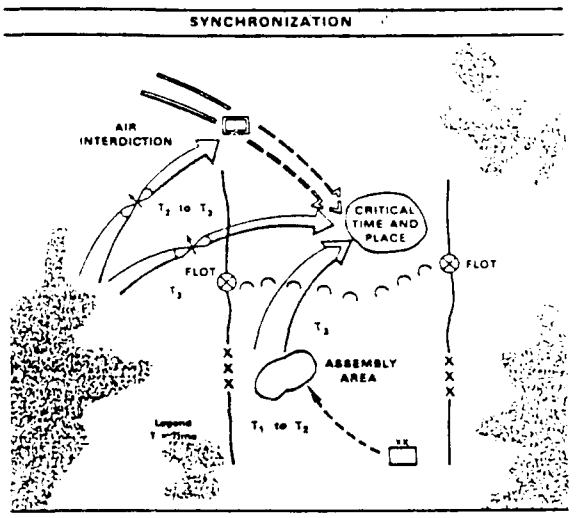


Figure 6. FM 100-5 Illustration of Synchronization

The previous definition of synchronization and the above diagram seem to be at odds with the next section in FM 100-5. The manual goes on to discuss the effects of actions that are separated in space and time.

> Synchronization includes but is not limited to the actual concentration of forces and fires at the point of decision. Some of the activities which must be synchronized in an operation...must occur before the decisive moment, and may take place at locations far distant from each other. While themselves separated in time and space, however, these activities are synchronized if their combined CONSEQUENCES are felt at the decisive time and place [FM 100-5, 17, author emphasis added].

> Thus, in an attack, supporting fires are synchronized with maneuver...to suppress...enemy indirect fire systems. Or on a larger scale, main and supporting attacks are synchronized if the latter takes place at precisely the right time and place to divert forces and fires from the main effort as it strikes the enemy. At the operational level, two operations are synchronized if the first, by attracting the bulk of the enemy forces, uncovers a key objective for decisive attack by the other [FM 100-5, 17, author emphasis added].

This important passage contributes to understanding the synchronization concept by addressing the linkage between widely dispersed actions and their accompanying effects. The example used above illustrates synchronization at the tactical and operational levels. Synchronization of friendly forces in one operation causes the enemy to draw off forces (an enemy action in and of itself), thereby creating an enemy vulnerability (reduction in enemy combat power), which is exploited by another force.

But the scope of actions and effects at the operational level requires an expanded view of the AO. The concept needs to discuss three ideas in more detail. What seems unclear is: (1) the ability of effects to occur in multiple mediums; (2) the effects of an action or group of actions to take place in one medium while their effects are felt in another medium; and (3) the variability of effects with respect to time, space, and forces. The manual needs to clearly point out that the actions of a force can produce variable effects in several mediums. This concept might best be accomplished by first using the time-mediums-forces effects windows as an umbrella concept. The windows could then be adjusted in size according to the level the commander operates at.

The next criteria requires the concept to address operational objectives. An understanding of how this criteria is handled illustrates how operational concepts are integrated throughout the manual. The term "center of gravity" is discussed in Appendix B of FM 100-5. The reader is referred to this section early in the manual, during the discussion of the concept of operational art [10]. This discussion focuses the operational artist's direction toward vital components, either in a direct or and indirect fashion. Later, on page 18, the summary of synchronization emphasizes "...unambiguous unity of purpose throughout the force." Therefore, if one examines the manual carefully, tying together several concepts that are distributed throughout the work, the reader can conclude that the current concept meets this criteria.

The third criteria requires development of the concepts of sequential and simultaneous actions and effects. FM 100-5's concept discusses the sequential and simultaneous nature of actions in detail. Note this passage below. The first paragraph addresses the importance of consideration of linking actions (activities) and effects (consequences) throughout the planning process. The second paragraph addresses actions as a part of the campaign plan.

> ...[S]ynchronization may and usually will require explicit coordination...however...such coordination is no guarantee of synchronization, unless the commander first visualizes the consequences to be produced and how activities must be sequenced to produce them. Synchronization thus takes place first in the mind of the commander and then in the actual planning and coordination of movements, fires, and supporting activities [17]....The less that synchronization depends on active communications (and more on implicit coordination through SOPs and understanding of the commander's intent), the less vulnerable it will be [18].

> Ground, air, and naval operations are synchronized to support each other and fulfill the requirements of the overall joint commander's campaign plan....Operational level commanders try to set favorable terms for battle by synchronized ground, air, and sea maneuver[;] by striking the enemy throughout the theater of operations...[; and by almost continuous protection,] reconnaissance, interdiction, air defense, and special operations [(including psychological warfare actions and unconventional warfare operations).]...[All operations must] be synchronized to support the overall campaign, and its supporting major operations on the ground, especially at critical junctures....[S]upport [also] must...function harmoniously...[28]

These passages illustrate the ideas of sequential and simultaneous actions in multiple mediums. The present concept does talk in terms of synchronizing functions such as reconnaissance, maneuver, and air defense. But they do not adequately address synchronization of sequential and simultaneous effects across multiple mediums. However, the author feels the current concept does address sequencing of operations.

The next criteria requires the synchronization concept to address actions, forces, and effects from perspectives of both concentration and economy of force. The initial definition addresses concentration when it advises production of "maximum relative combat power at the decisive point [17]." The manual goes on to state

> In the end, the product of effective synchronization is maximum economy of force, with every resource used where and when it will make the greatest contribution to success and nothing [is] wasted or overlooked. To achieve this requires anticipation, mastery of time-space relationships, and a complete understanding of the ways in which friendly and enemy capabilities interact. Most of all, it requires unambiguous unity of purpose throughout the force [18]....

Therefore the manual does address concentration and economy of force. The manual could be more clear on the development of synergistic effects developed as a result of concentrated actions, or even widely displaced actions. The manual could also address repeated concentrations of effects and economy of force throughout the campaign, in different mediums and locations.

The fifth criteria is the requirement to address the elements of uncertainty and chance in the synchronization concept. The manual does address the enemy as a variable in the synchronization problem as it states

> Ground operations require coordinated movement and effective concentration of large units...against the enemy in spite of his efforts to interdict the friendly forces' movement [28].

The manual also addresses the uncertain nature of effects. The discussion of the continuous nature of the estimate process parallels DePuy's "dynamic synchronization" concept of continuous evaluation. This concept of continuous situation analysis is adequately referred to in tactical planning [33]. At the operational level, the idea of planning branches (changing plans in operations that are underway [30]) and sequels (actions after battle [31]) addresses countering uncertainty in planning friendly actions. The continuous nature of this planning needs to be emphasized. Since effects are the result of actions, variants to the plan directly address the uncertainty of effects. What also should be emphasized is the uncertain variability of the effects due to chance and the observation that few, if any, effects can ever be predicted with one hundred percent accuracy.

Finally, the sixth criteria requires the synchronization concept to have a future orientation. First, that means the concept should have a joint and combined flavor. The next passage addresses this point, demonstrating the first part of the future-orientation requirement.

> The Army Component Commander (ACC)...must maintain synchronization over large areas. This will always involve...maintaining effective cooperation with other armed services of the US...and...the [air, ground, or naval] forces of allied nations assigned to [the ACC] [28].

Next, the concept should also be applicable in any environment, type of operation, or in any general state along the operational continuum. The present concept is useful in a state of war. But the concept should be adaptable to peacetime competition and conflict. This means there should be some mention of civilian-political-military agency linkage. A discussion of effects produced by civilian agencies that support the operational artist should be included with this concept. This would require a major adjustment in the concept of synchronization. More importantly, it might require an evolutionary change in the nature and focus of FM 100-5.

To review, although the concept has a joint and combined flavor, it does not apply along the entire spectrum of conflict. The concept therefore does not meet the basic requirements in the sixth criteria. The paradigm of the present synchronization concept is drawn below.

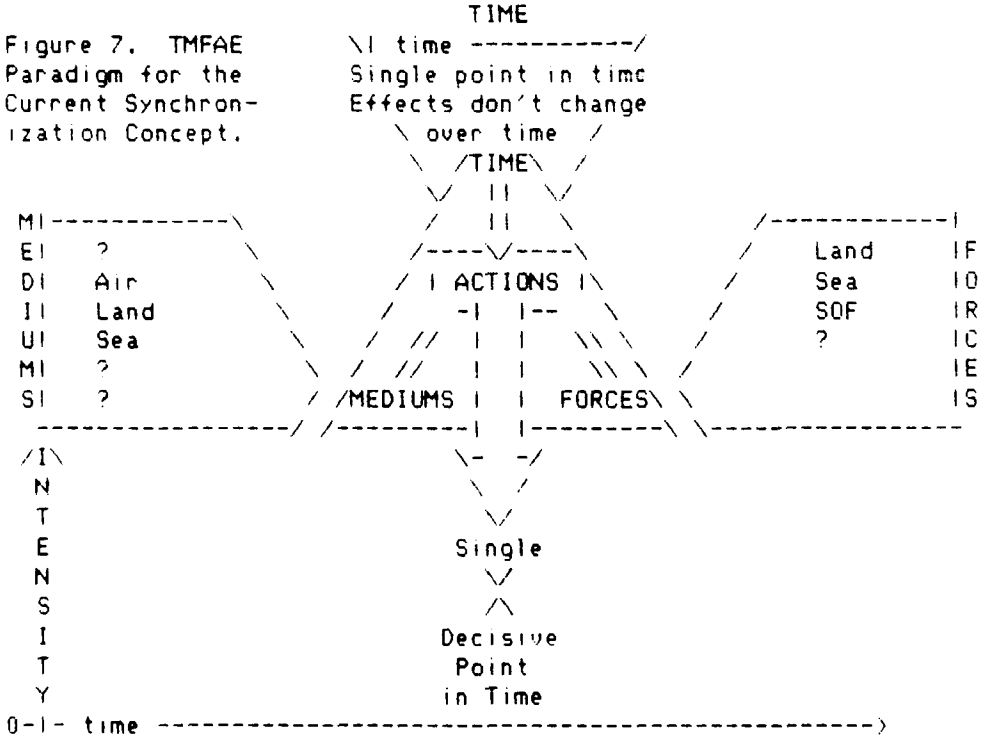


Figure 7. TMFAE Paradigm for the Current Synchronization Concept.

The FM 100-5 evaluation matrix appears below.

CRITERIA	Meets Criteria? YES	NO	Shortfalls
Windows of Effects		X	MEDIUMS, CHANGES OVER TIME
Operational Objectives	X		
Sequencing of Actions, Effects		X	MEDIUMS, EFFECTS
Economy of Force	X		
Flexibility	X		MEDIUMS, EFFECTS OVER TIME
Future-Oriented		X	FULL SPECTRUM OF CONFLICT

Figure 8. Evaluation Checklist for Current Synchronization Concept

Two major conclusions are drawn from a review of the current concept. First, concepts relating to synchronization are found throughout the manual, demonstrating the integral part that this concept plays in AirLand Battle and the operational art. Because of this, the reader has to closely examine the entire manual to gain a good understanding of the concept of synchronization.

Second, the FM 100-5 concept is a sound base upon which to build a concept for operational synchronization. Some shortfalls need to be addressed for it to be of more utility to the operational artist. Basically, the concept needs to take on a wider perspective in the area of effects. The graphics need to reflect this change also. It needs to address variable effects across multiple mediums. It needs to discuss effects in space, EW, and psyops mediums. And it needs to get away from the "single point in time" philosophy to a blending of time-mediums-force windows of effects. Finally, it needs to consider actions and effects of civilian agencies that work with the operational artist.

Revisions to the Current Concept

The current concept appears to be a sound basis for the discussion of synchronization in the revised FM 100-5. The author feels there is no need to address all criteria when discussing the revised concept. But several issues will be highlighted that were brought out in the previous section. These issues include expanding the concept of effects, making the concept applicable to the full spectrum of conflict, and organizing the concept for presentation in the revised FM 100-5.

The main shortfall of the present concept lies in the relationships of variable effects in multiple mediums. The author will address these shortfalls,

using a revised Time-Mediums-Forces Effects Paradigm. Asterisks (*) in the revised paradigm reflect changes to the present concept.

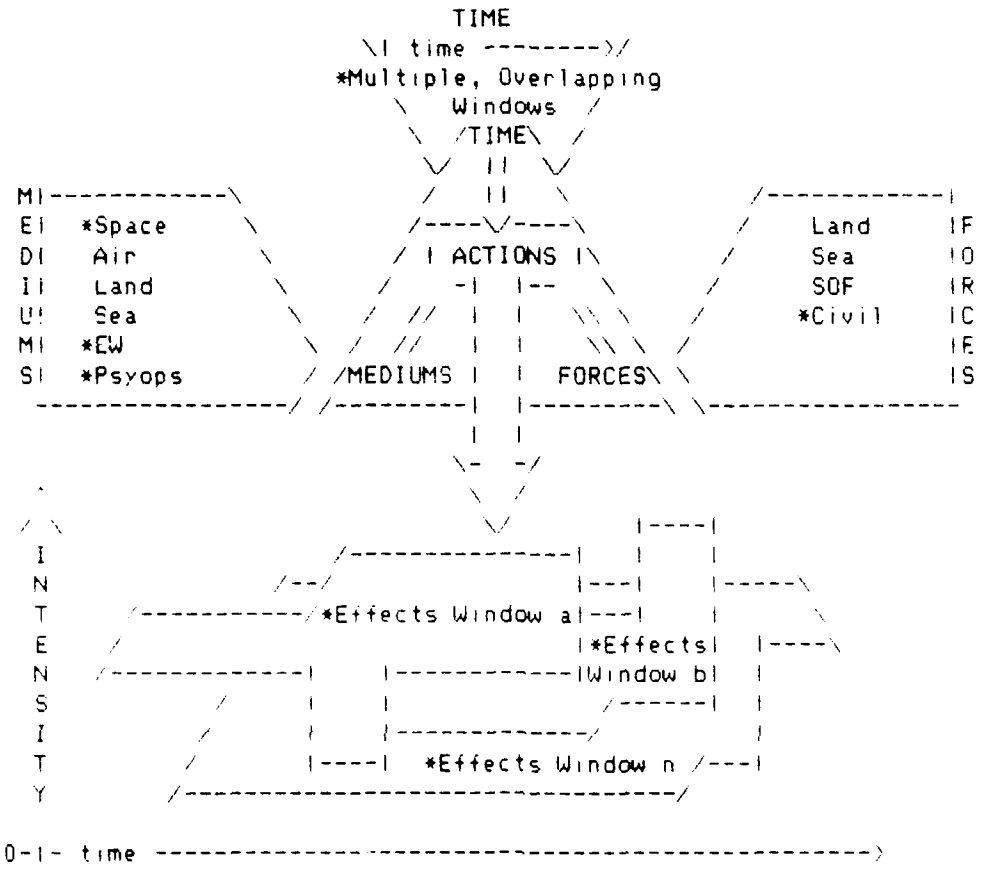


Figure 9. Revised TMFAE Paradigm for the Synchronization Concept

Several changes have been made to the paradigm of the present concept. There has been a subtle change to the perspective of the TIME Block. What has changed is the perception of time linked with forces, mediums, actions, and effects. TIME can be visualized as an instant, a block, or a common denominator that is used to put actions and effects in perspective. This supports the concept of windows (blocks) that are used to delineate the "size" of effects over time.

The FORCES Block still contains the requisite air, land (USMC and USA), sea, and special operations forces. But the present concept neglects the actions and effects of civilian agencies that act in concert with the military forces of the operational artist. Therefore, civil has been added to the FORCES Block. This serves to emphasize the necessary linkage between all types of civilian agencies, particularly the State Department. "Civil" could represent, for example, additional

intelligence support from the CIA or humanitarian assistance from elements of the State Department.

Changes have been made to the MEDIUMS Block also. The operational artist's environment contains three additional mediums: space, EW, and psyops. The medium of space is defined by Kenneth Myers and John Tockston as an infinitely large operating medium in which an object attains orbital flight, in an environment of weightlessness and vacuum. It is different than the multi-dimensional air medium characterized by powered flight in an environment of atmospheric forces [1988, 59]. Actions and effects in space can influence primarily command and control and intelligence functions.

The EW medium represents the "...use of electromagnetic energy to determine, exploit, reduce, or prevent hostile use of the electromagnetic spectrum and action that retains friendly use of the electromagnetic spectrum [FM 34-1, Intelligence and Electronic Warfare Operations, 1987, 2-17]." This medium will no doubt receive greater attention in the future and represents a medium for non-lethal electronic "fires."

The Psyops medium expands the concept, concentrating on the cybernetic and moral domains of warfare. Effects in the cybernetic domain impact on organization, command, control, communications, and information. Effects in the moral domain impact on the will of the opponent [Schneider, 1988,6-7]. Psychological actions produce effects on "...the national will of friendly, neutral, and hostile forces and societies. They do so by influencing the thoughts and actions of targeted groups so that those groups choose to support...[the operational commander's] policies and objectives [FM 33-1, Psychological Operations, 1987, 1-1]." For example, this medium allows deception operations to be measured in terms of "cybernetic" hesitation in the mind of the opposing commander.

FORCES perform ACTIONS in MEDIUMS, over TIME, to produce EFFECTS. The tactical concept of operational synchronization may demand effects that are concentrated at a decisive time and place. But the operational artist has neither this luxury nor this capability. Therefore, the operational artist should work to produce multiple windows of effects. These windows vary in intensity over time and between mediums. The object of the operational artist is to first overlap these windows, and next, achieve a harmonious, synergistic blend of these effects windows. The "size" of the effects window varies due to the type of action,

amount of combat power applied, the effects of chance and uncertainty, and many other factors. One must consider chance and uncertainty and build room for error into each desired window of effects. It is just this quality that forces the operational artist to be creative, shaping effects to his purpose and proactively responding through dynamic synchronization to changing conditions.

A group of doctrinal planning tools that assists in translating operational actions into effects, and visa versa, would be useful. The Operational Operating Systems (OOS) are one set of tools that may have some use in this effort. TRADOC Pam 11-9 (Draft) states that the OOS are

> ...major functions performed by joint and combined operational forces for successfully executing campaigns and major operations in a theater or area of operations. [The OOS are]...sufficiently comprehensive in order to cover functions performed by joint (and combined) forces (air, space, land, and sea) [4-1].

TRADOC's Pamphlet 11-9 (Draft), offers a group of functions including command and control, movement and maneuver, fires, intelligence, protection, and support. To this list the author would add civil affairs. This paper is too short to discuss the OOS in detail. The author will only discuss here the links between operational synchronization and the OOS.

The OOS can assist the operational artist in several ways. They represent functions that should be performed by the operational artist's force as a whole or by major subcomponents. For example, contributions to the intelligence function are made by elements of all forces. Operational maneuver may be at any one time only be performed by a single service or a multi-service grouping of forces. The OOS assist in defining forces, their capabilities, and their functions. OOS also assist in understanding force effects and actions.

In the author's view, the OOS work two ways in understanding the link between actions and effects. First, the OOS help translate capabilities and actions into effects in mediums. For example, a force can perform support functions in order to increase its potential combat power. Second, the OOS assist in converting effects into actions. For example, the operational artist can generate uncertainty and hesitation in the enemy through deception.

A suggested effects synchronization methodology illustrates the revised concept of the actions-effects linkages in campaign planning.

Another holistic view that assists in understanding operational synchronization is the linkage between strategic guidance and available, executable actions and resultant effects. Paul Melody, a current SAMS student, suggests a dialectic approach. He asserts that this dialectic process produces a synchronized linkage of strategic guidance and possible tactical actions and effects [SAMS-S3, 1990].

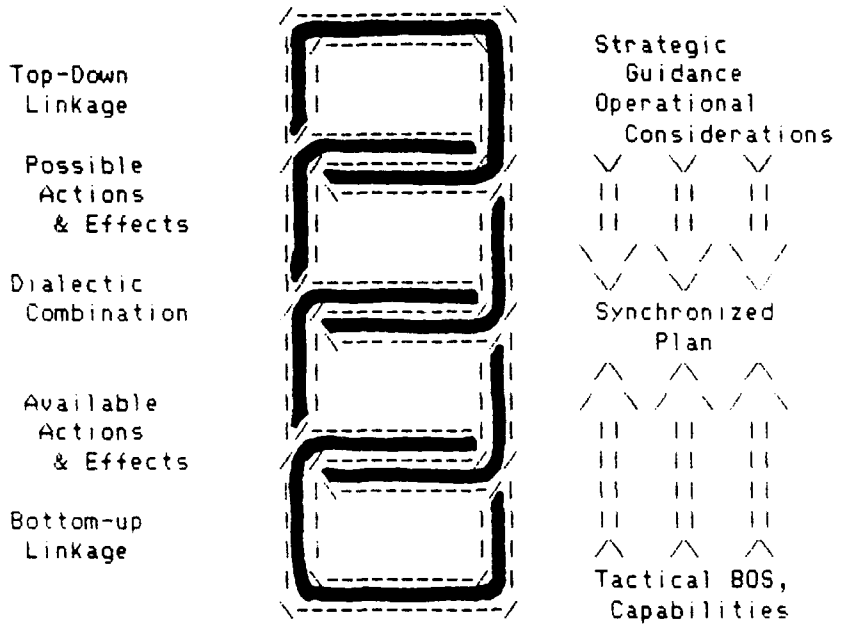


Figure 10. Dialectic Linkages of Strategic Guidance and Tactical Capabilities

The operational artist receives strategic guidance. He has available to him possibilities based on the forces he has available, within constraints placed on him by his superior. Although the strategic guidance takes precedence, through a dialectic process the guidance and possible tactical effects that can be produced combine to form a synchronized plan of actions. The dialectic process is dynamic and continuous. It works throughout the campaign of the operational artist. This plan produces synchronized effects that achieve the strategic objective. This leads to the first step in the Effects Synchronization Planning Methodology (ESPM).

STEP 1: Receive Strategic Guidance: Define the strategic task and purpose.

Figure 11a. ESPM STEP 1: Define the Objective

The entire methodology is located at Appendix A.

In STEP 2, the operational artist develops an appreciation for the situation he is in. He uses the Time-Mediums-Force-Effects Paradigm to understand friendly and opposing capabilities, actions, and effects.

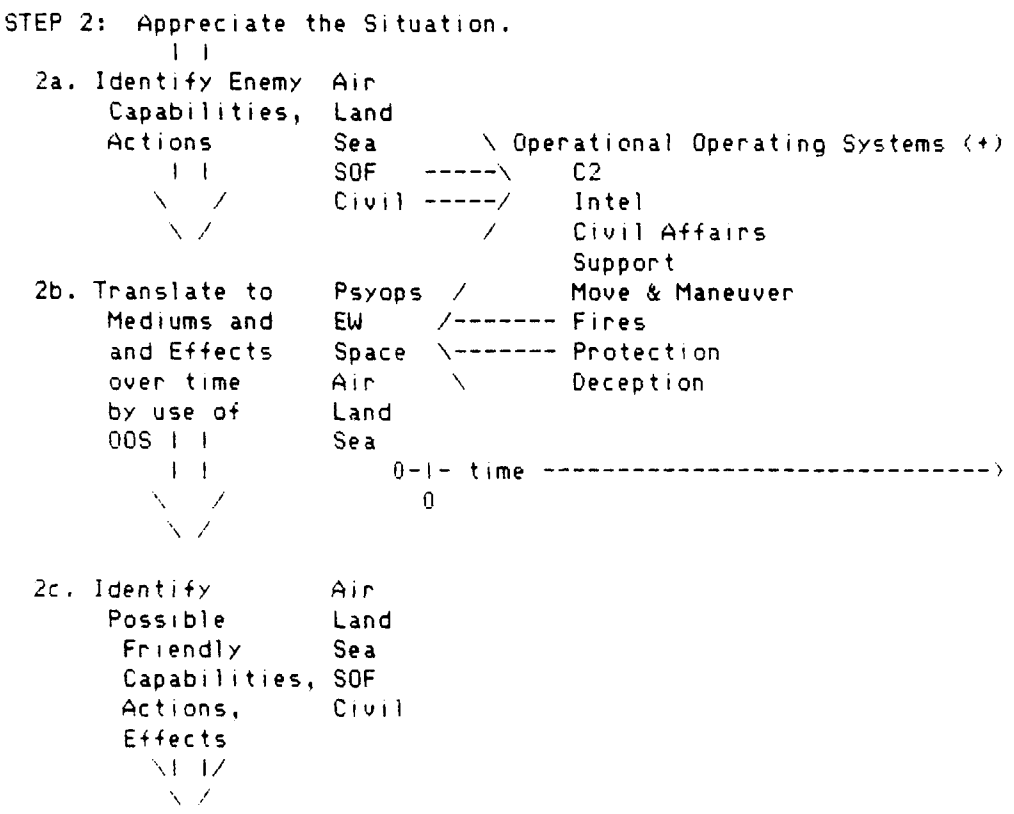


Figure 11b. ESPM STEP 2: Appreciate the Situation

The factors of time, mediums, forces, effects, and actions are studied from both the friendly and opposing point of view. The operational artist gains an understanding of his situation, opposing forces, and the potential capabilities of his own forces. Opposing force capabilities and actions are identified. These actions are then transformed, with the assistance of the OOS, into possible opposing force effects, and effects on friendly forces.

Note the listing of the OOS in the methodology. The listing represents the author's recommended, prioritized manner in which the operational artist should consider each function of the OOS. First, unity of command and effort is defined. Then the operational artist gains an appreciation of the situation through an understanding of relationships of the functions of intelligence, civil affairs, and

support. Then the operational artist develops his plans for movement and maneuver, fires, protection, and deception.

Campaign planning itself represents the synchronization of effects through actions. Having understood the situation, the operational artist uses STEP 3 to develop his vision of the campaign in general terms and gross effects and actions.

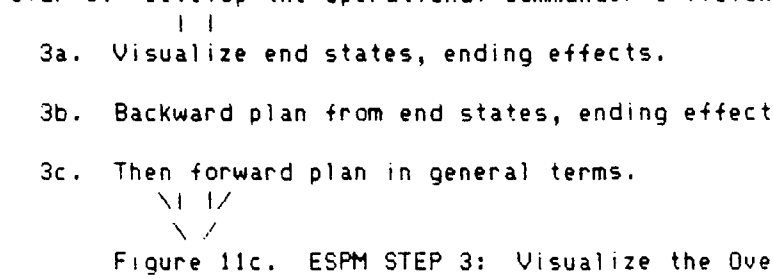


Figure 11c. ESPM STEP 3: Visualize the Overall Plan

The product of STEP 3 is a general concept of the campaign in gross terms, an operational vision of the campaign as a whole. The operational artist first visualizes the operational endstate and effects he wishes to create. He then backward plans, asking himself what effects sequence will arrive at this end state. Finally, he traces the effects in their forward sequence as a check to ensure they logically arrive at the desired end state. Then detailed planning occurs.

STEP 4 in the methodology is used by the operational artist and his staff to develop the detailed plan.

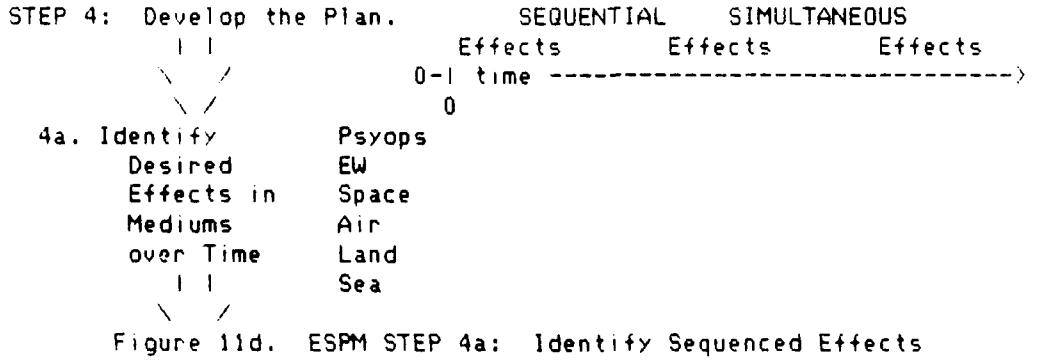


Figure 11d. ESPM STEP 4a: Identify Sequenced Effects

STEP 4a identifies the desired effects required over time to achieve the desired end state (ending effect). It is essentially a refinement of STEP 3b, the forward-looking general plan of the campaign.

Effects are envisioned as a result of functions that are performed by the force as a whole. Both sequential and simultaneous effects are considered. For

example, in a contingency AO potential combat power might have to be deployed before the next effect (reduction of opposing land force combat power) can be sequenced. The effect is the creation of potential combat power at a location where it can be effectively used against the opposing force. The action is the deployment of the forces. An example of a simultaneous effect is the creation of air superiority while simultaneously building up potential combat power.

Next, STEP 4b turns these sequential and simultaneous effects into actions in terms of functions that are performed by the operational artist's force.

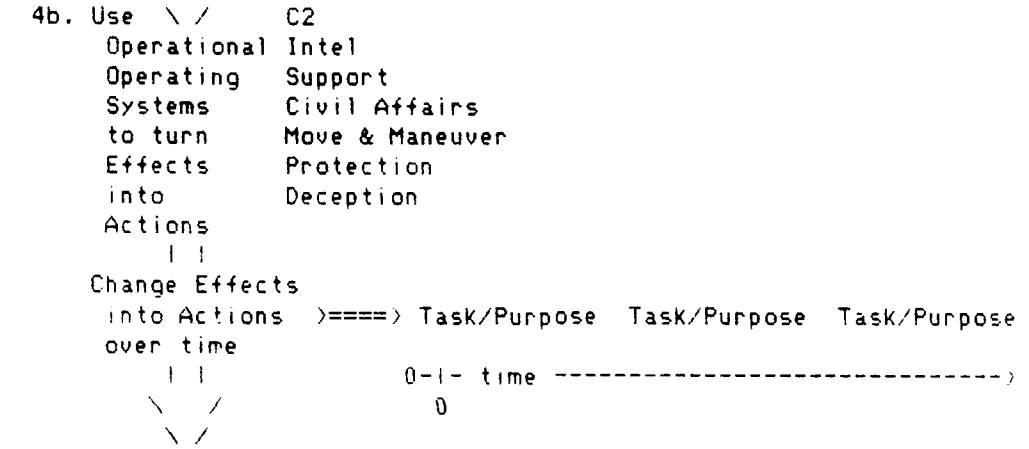


Figure 11e. ESPM STEP 4b: Turn Phased Effects into Actions

The product of this step is the development of phased effects, converted to tasks and purposes, for the operational artist's force as a whole. Both simultaneous and sequential effects are converted to simultaneous and sequential tasks and purposes.

Finally, detailed actions (tasks and purposes) are planned in STEP 4c. In this step of the methodology the preceding tasks and purposes are first converted into campaign phases. Consideration is given to conducting one or more major operations simultaneously. To return to a previous example, land force deployment and the attainment of air superiority can both be considered major operations. These actions could conceivably be carried on simultaneously. Both of these major operations also contribute to the build-up of potential combat power, the overall goal of the first phase of the operation.

Several other actions are taken in STEP 4c. The initial phase of the campaign is planned in detail. Missions and resources are assigned and allocated

to forces. Branches and sequels are also planned for. ESPM STEP 4c is shown below.

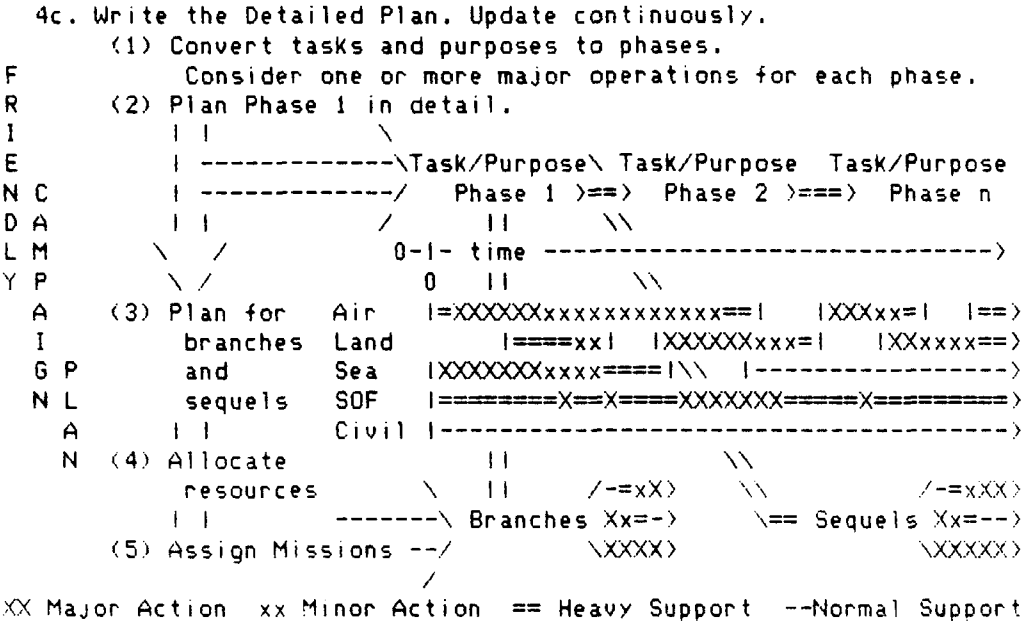


Figure 11f. ESPM STEP 4c: Write the Detailed Plan

This discussion has centered on developing a revised view of actions and effects. One other shortfall is the applicability of the synchronization concept across the full spectrum of conflict. The present concept readily applies in the general state of war. Actions and effects should be synchronized in the states of peaceful competition and conflict.

Some changes to effects windows are evident in these states. Windows of effects will most probably expand in time and decrease in intensity. More time will be required to institute most programs generated by civilian agencies. Effects windows for violent military actions may increase in intensity but take place in a very short amount of time. The cross-medium nature of effects will increase in importance as the effects of military actions are considered on the indigenous population in the Psyops medium. Finally, periods of overlapping, synergistic effects may decline due to the difficulty of synchronizing military effects with additional civilian actors and agencies involved in the campaign.

The third point of discussion for the revised concept applies to its presentation within the manual. The concept of synchronization is an integral part of AirLand Battle doctrine, as evidenced by its inclusion as one the basic tenets.

Additionally, since the publication of the DePuy article, the discussion of synchronization has been associated with an increasing number of actions, effects, and planning tools.

FM 100-5 needs to present an organized view of synchronization that clearly fleshes out the concept and illustrates its application across the spectrum of conflict and the three levels of operations. The author suggests the concept of synchronization in FM 100-5 be presented first as a general concept. This section would bring together concepts similar to the criteria used in this paper to evaluate synchronization. The next section should cover synchronization as a consideration in planning. Then synchronization of planning and execution should be covered. This should be followed by a discussion of synchronization of actions and effects during execution. Each section should contain examples for the operational and tactical commander. Each section should also address actions across the full spectrum of conflict, with a joint and combined flavor. Graphics should be used to highlight important ideas. The result should be a more comprehensive overall concept that addresses synchronization doctrine for both the tactical commander and the operational artist.

This section discussed some ideas for alleviating shortfalls of the present synchronization concept. The author suggested including the concepts of effects windows, mediums, and actions-effects linkages. It also demonstrated elements of a revised concept using a synchronization methodology. The author also suggested expanding the concept to show that it works in any state along the spectrum of conflict. Methods of organizing the revised concept were also covered.

The revised concept incorporates a holistic view of synchronization of actions and effects. It also uses an holistic, dialectical view of synchronization of strategic guidance and tactical capabilities. It uses the concept of multiple, variable windows of effects that are produced across one or more mediums. The revised concept addresses concentration and economical use of effects, integrated within the rubric of a campaign plan. The revised concept addresses the effects of uncertainty and chance on actions and effects. Finally, the revised concept attempts to continue along what the author feels is an evolutionary path in the development of Army doctrine as it ties in civil affairs actions and effects as a consideration for the operational artist.

Conclusions and Implications

The author feels he can draw several general conclusions from this study. First, the concept of synchronization is well supported by military theory. Next, a review of Joint and Army doctrine reveals that the concept of synchronization is not developed sufficiently in key JCS manuals to provide umbrella operational concepts for DoD forces. The concept is simply not developed as a useful, understandable concept in any JCS or Army doctrine save FM 100-5. Next, the development of the concept as a tool for Army professionals parallels the development of the operational art. Also, a gap appears to be developing in Army doctrine at the operational level. JCS Pub. 3-0 and FM 100-5 provide umbrella concepts for operations in general. FM 100-15 focuses at the tactical level. There is no Army manual that specifically addresses operational art in detail.

Some specific conclusions can also be drawn concerning the usefulness of the Army's present synchronization concept. The concept of synchronization, as outlined in FM 100-5 (1986) is mainly a tactical concept. It does not incorporate portions of the environment (space, EW, psyops) that could become parts of battlefields in the future. The present concept also appears to deal primarily with synchronization of actions, not the effects they create. A more holistic view of actions and effects needs to be built into the present concept.

Synchronization of effects needs a better treatment. Effects vary over time, through space in one medium, and across mediums. Additionally, it is much more difficult to achieve synergistic effects at a single point at the operational level than it is at the tactical level. The author suggests the concept of time-space-force windows better portrays effects at the operational level. These windows of effects can even be used to illustrate synchronization of effects at the tactical level.

The author also suggests that the campaign planning process can be built around planning for and synchronizing first effects, then actions.

FM 100-5 doctrine writers must carefully plan the presentation of the concept of synchronization. This complicated concept is an integral part of AirLand Battle. As such, it is connected in some way to most facets of AirLand Battle doctrine. Doctrinal writers need to plan the presentation of synchronization to achieve an integrated view of theoretical concepts and effects-actions linkages that apply across the entire spectrum of conflict at the tactical and operational

levels of the use of the military elements of power. Also, graphics should illustrate important concepts.

Further study is needed in many areas, including the use of the concept of synchronization in the situation where more than one general state of the operational continuum exists simultaneously. Next, TRADOC Pam 11-9 (Draft) points out that the OOS do not apply to peacetime competition or conflict. If that is the case, should they be combat development or doctrinal tools? Also, AFP/FM 100-20 specifically states that civil affairs operations should be synchronized with military operations. How should this be accomplished? Finally, joint doctrine writers and other services should consider incorporating these concepts into their doctrine.

Above all, the Army needs to develop an umbrella concept for synchronization. The concept should be applicable to the tactical, operational, and strategic levels. It should also apply across the entire operational spectrum. The upcoming revision of FM 100-5 gives the Army a great opportunity to clarify the synchronization concept in general and operational synchronization in particular. The current concept has a tactical flavor and is most useful at the tactical level in the JCS-defined operational state of war. Even so, this concept is a good starting point for a more overarching concept that applies to the operational artist. Revision of the present concept will hopefully lead to a more useful tool for the tactical commander, the operational artist and the strategist.

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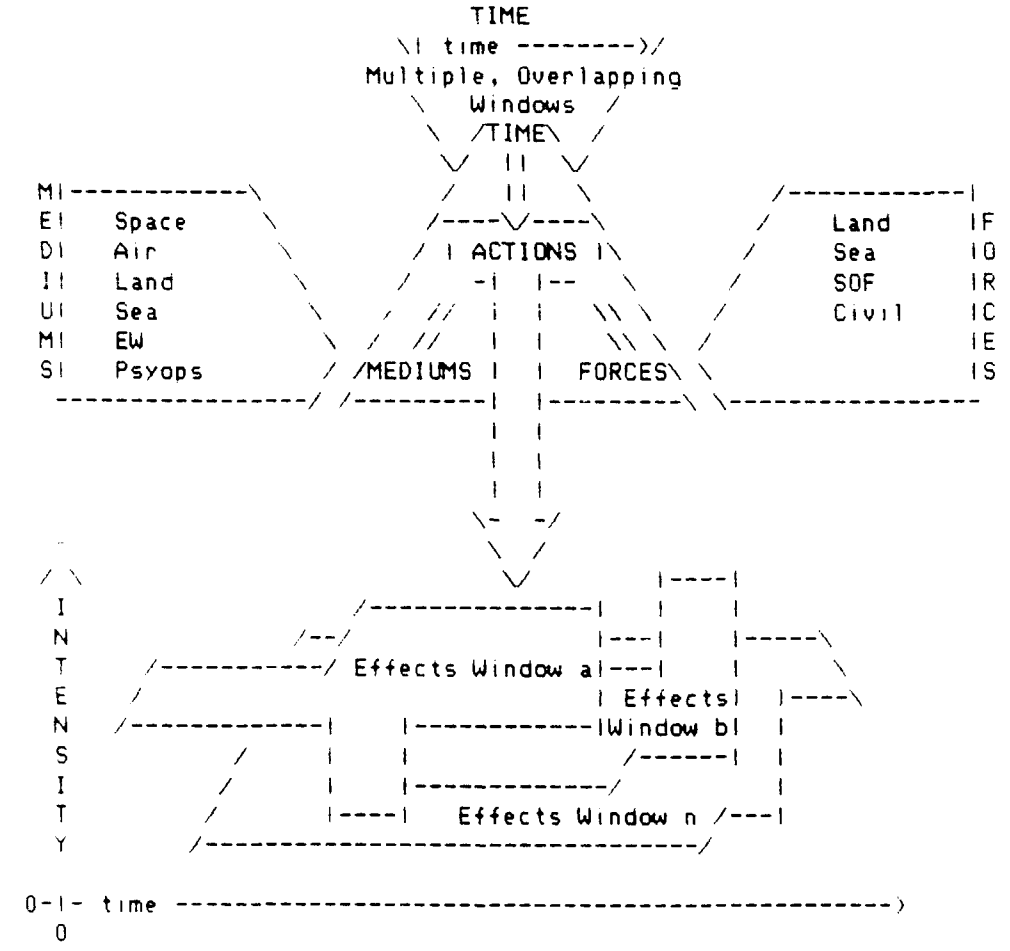
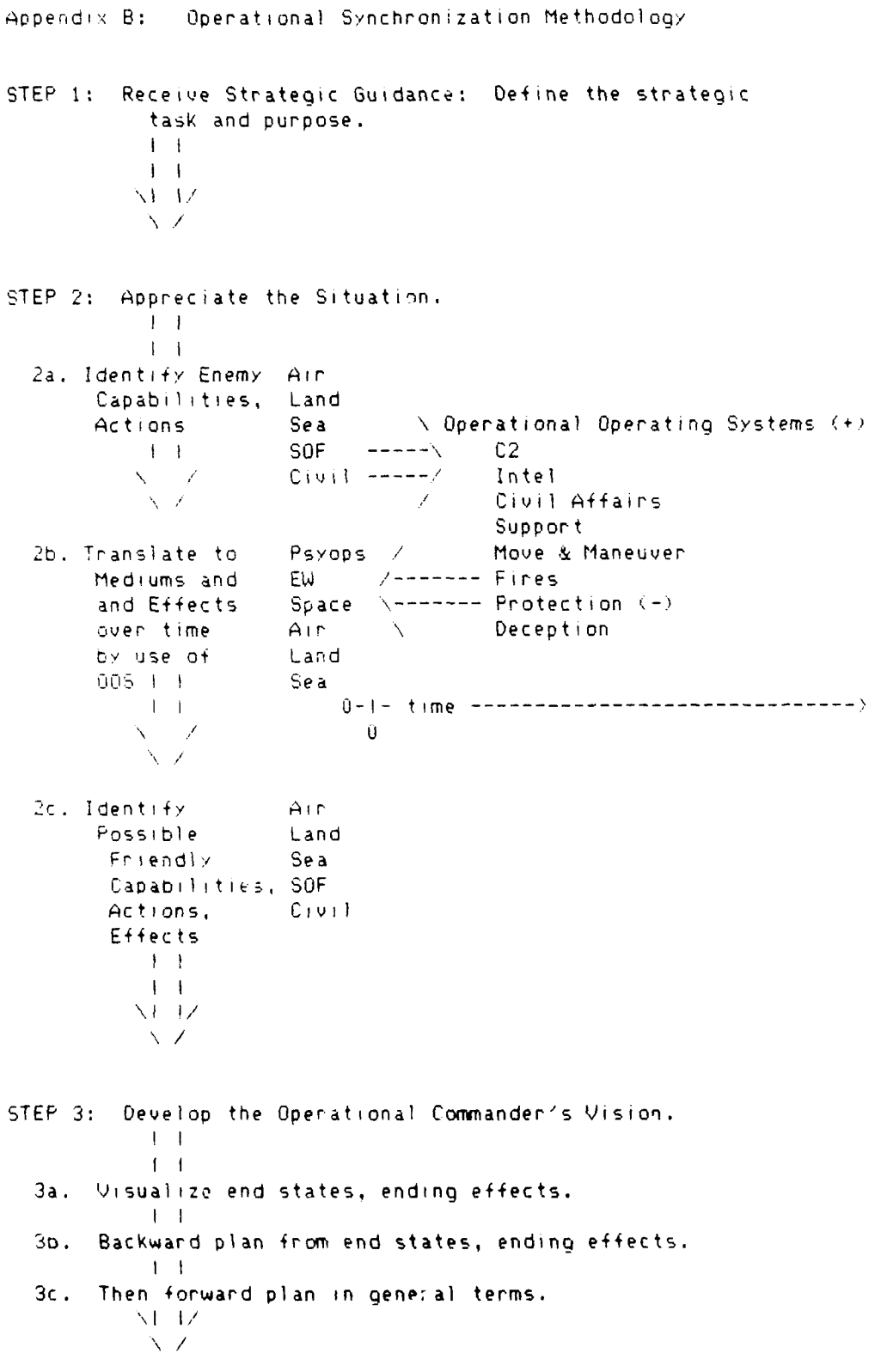
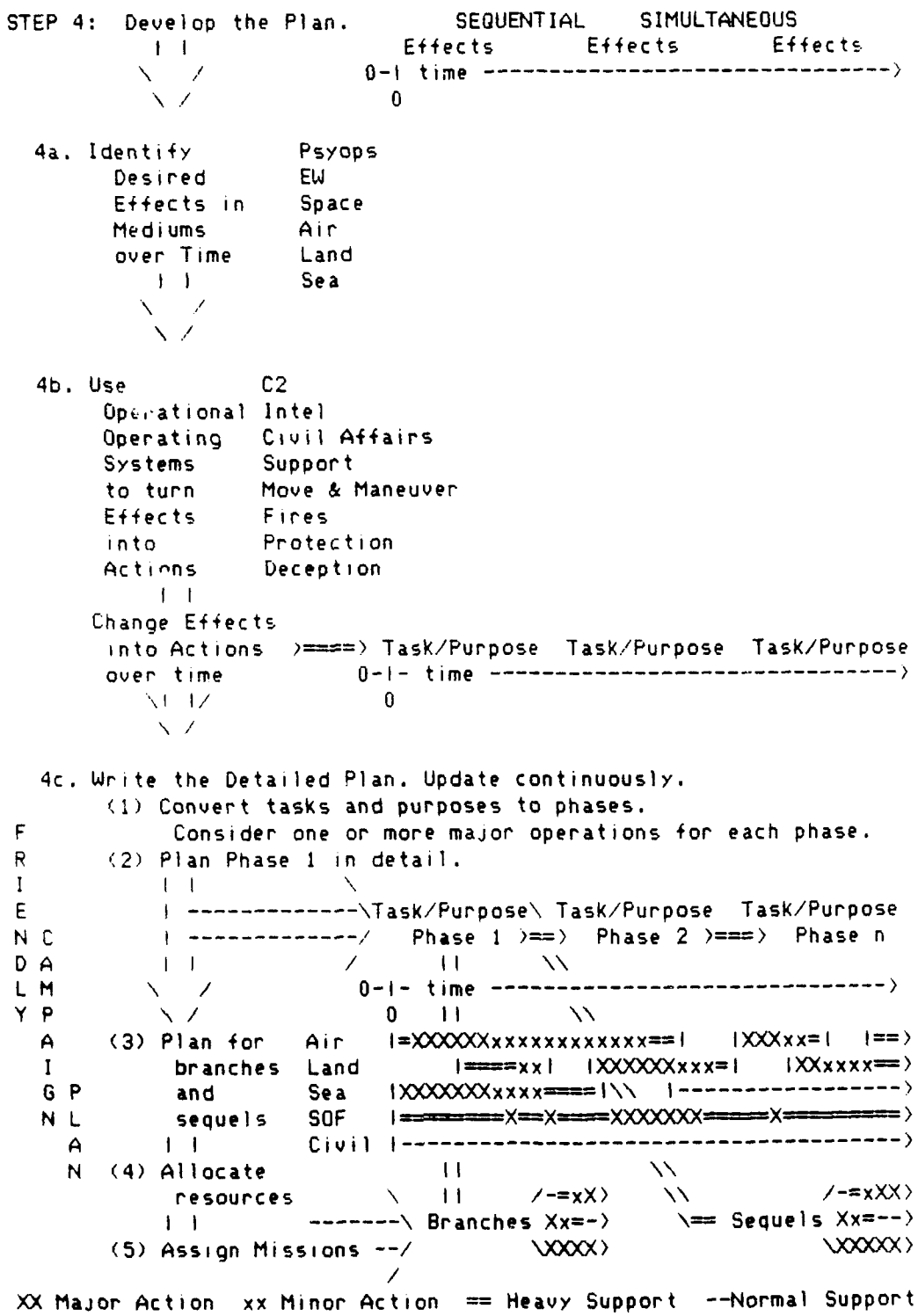
Appendix A: Time-Mediums-Forces-Actions-Effects Paradigm



Appendix B: Operational Synchronization Methodology




STEP 4: Develop the Plan.
SEQUENTIAL
SIMULTANEOUS
Effects
Effects
Effects
0-I time
0
4a. Identify
Desired
Effects in
Mediums
over Time
Psyops
EW
Space
Air
Land
Sea
4b. Use
Operational
Operating
Systems
to turn
Effects
into
Actions
C2
Intel
Civil Affairs
Support
Move & Maneuver
Fires
Protection
Deception
Change Effects
into Actions
over time
Task/Purpose
Task/Purpose
Task/Purpose
0-I- time
0
4c. Write the Detailed Plan. Update continuously.
(1) Convert tasks and purposes to phases.
Consider one or more major operations for each phase.
(2) Plan Phase 1 in detail.
Task/Purpose
Phase 1
Task/Purpose
Phase 2
Task/Purpose
Phase n
0-I- time
0
(3) Plan for branches and sequels
Air
Land
Sea
SOF
Civil
(4) Allocate resources
(5) Assign Missions
Branches
Sequels
XX Major Action xx Minor Action == Heavy Support --Normal Support